FOREST
*Management*
BULLETIN

# FOREST MANAGEMENT AND THE CHIPPING HEADRIG

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## INTRODUCTION

A square peg may not fit in a round hole, but a square timber can be chipped out of a round log. The chipping headrig, commonly known as "chip-and-saw," does just that with positive results for the manufacturers and growers of southern pine timber. This bulletin was developed to inform foresters and landowners about this processing technology and the impacts, both positive and negative that it can have on growing and marketing southern pine timber.

Simply described, the chipping headrig is a machine with rotating cutter-heads positioned along both sides and the top and bottom of a conveyer system carrying a debarked log (figure 1.). By chipping off the sides, a flat or profiled four-sided cant is produced which is then resawn into boards and planks. Resaws may be band or circular and may be close coupled or remote to the chipping headrig.

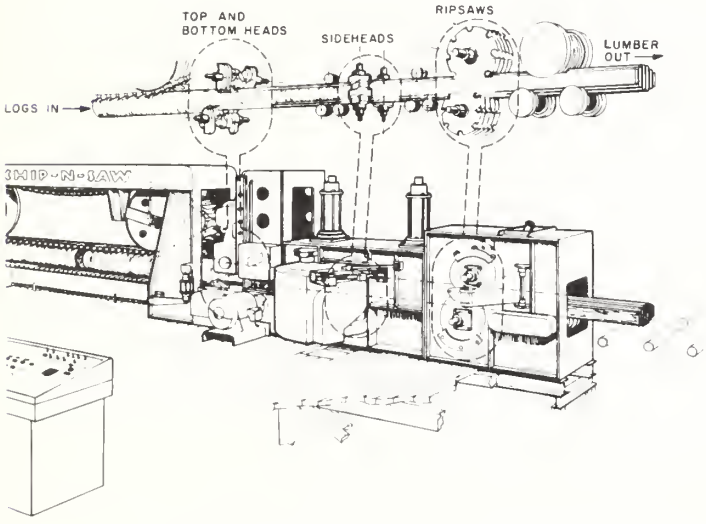


*Figure 1. The chipping headrig chips cants out of small debarked logs and then saws the cants into boards. At fast speeds (100-200 linear feet of logs per minute) it produces high volumes of relative high valued products. Stumpage prices are usually higher for the trees used in this process than for pulpwood.*

Logs are placed end to end and can be run through the debarker, chipping headrig and resaw at a speed ranging from 100 to 200 feet per minute. This process contrasts remarkably with a conventional sawmill carriage on which only one or at best two, 16-foot logs can be loaded, converted to lumber, and off-loaded each minute.

With the chipping headrig, logs as small as 5¼ inches in diameter at the small end can be converted into 4 inch by 4 inch cants. From such cants, the processor can make two 2 by 4's where previously these small logs produced only fiber for pulp and paper. The 2 by 4's alone are worth approximately four times the value of the same 5¼ inch log converted to chips. Tree sizes harvested today are typically smaller than the trees harvested at the beginning of this century. The development of the chipping headrig is one of many processing technology changes that resulted from a smaller average tree size. These simple facts have vastly expanded the amount of timber classified as "chip-and-saw" instead of pulpwood.

Timber purchasers are willing to pay more for timber that will yield higher-valued end products. Across most of the South, pine sawtimber stumpage is generally three to four times more valuable than pine pulpwood. Stumpage prices for chip-and-saw are usually lower than sawtimber but two to three times higher than pine pulpwood (figure 2).

Without question, this sawmill process technology widely adopted in the early 1970's, has had a profound impact on the manufacturing of southern pine timber. But what about the impact on those who grow the trees that are the raw material for wood processing plants? Does the chipping headrig have positive or negative results for timber landowners? The not so simple answer is—it may be either one, depending on how landowners "play their management cards."

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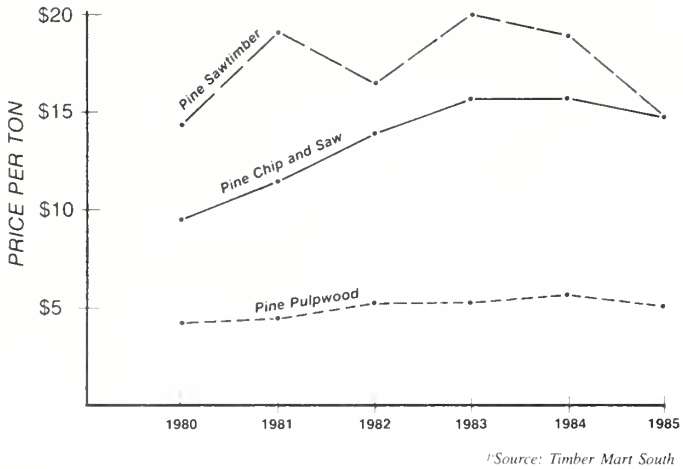


*Figure 2. Relative stumpage prices of three pine products 1980-85[1] for the Southeast.*

## STAND MANAGEMENT CONSIDERATIONS

When maximum economic return is the objective, the key to good timber management is to grow the most of the highest valued product in the shortest time at the least cost that local markets will accept. Across much of the South, this often suggest short sawtimber rotations. But a stand of young seedlings must grow through several product classes (post, pulpwood, chip-and-saw) before the majority of the stems reach sawlog size (10"+DBH). Normally intermediate as well as final harvest cuts will yield good chip-and-saw volumes from stems not yet large enough for sawtimber (figure 3).

*Figure 3. Most young pine poletimber stands have the potential of producing several stumpage products. This 20-year-old stand is currently carrying a heavy pulpwood volume and is just before growing into a size suitable for the chipping headrig.*

Before selling timber, landowners should determine the volume present in each product class and how much of the volume should be sold, and how much should be retained in each product class to meet the present and future landowner objectives (figure 4). With this in mind, candidate timber sale stands can be scheduled for sale when the maximum immediate and longterm return can be realized. The chip-and-saw market adds a new dimension to the thinning strategy debate.

*Figure 4. Landowners wishing to maximize financial returns should give careful consideration to the timing and degree of thinnings as well as merchandising the trees to be sold into the highest valued product class. The advise of a forester is helpful and often necessary to do this.*

Thinning strategy involves the timing and degree of intermediate harvests and is influenced by a number of factors broadly grouped as economic, biological, and ownership objectives. Biological factors, for example, are affected by risk of loss to southern pine beetle infestation, while ownership objectives may range from multiple use to supplying wood for a pulpwood mill. Economic factors are affected by interest rates, operability, and the relative price structure among various products within the market area.

Historically, the price structure for southern pine stumpage has strongly favored solid wood products (sawtimber) over pulpwood or chips. Chip-and-saw utilization complicates these relationships, but in general, solid wood is still more valuable than an equivalent volume of pulpwood chips.

So how does the chip-and-saw market influence the timing and degree of thinning? Basically, if the local

market for pulpwood is weak relative to the chip-and-saw market, then consider doing only light (sanitation-salvage cutting) thinning in well stocked stands prior to age 20. This will allow a greater portion of the total stand volume to move into the solid wood category and substantially increase the value of the first commercial thinning.

However, if both the local pulpwood and sawtimber markets are strong, a heavier early thinning is valuable to maintain good diameter growth and move the stems into the solid wood product class as quickly as possible. Heavy early thinning will probably increase pulpwood and early sawlog yields but decrease chip-and-saw yields. In all cases, timber sellers should be aware of the long range adverse consequences of cutting and selling the dominates and co-dominates in a thinning operation just to capitalize on the higher chip-and-saw stumpage prices.

The growth and development of each stand is different as influenced by such factors as species, initial stand density and site index. Table 1 is an example of what might be expected from a thinned loblolly pine stand on an average site as it moves from one size and/or product class to another.

Table 1. Estimated number of trees, basal area, and volume yield per acre, before harvest for a 35-year-old loblolly pine plantation thinned at age 15 and 25[1].

| | Stems Per Acre Age | | | Basal Area Age | | | Cubic foot volumes to top DOB 4″ Age | | | 6″ Age | | | Board foot vol. to an 8″ top DOB Age | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DBH | 15 | 25 | 35 | 15 | 25 | 35 | 15 | 25 | 35 | 15 | 25 | 35 | 15 | 25 | 35 |
| 2 | 2 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 3 | 20 | — | — | 1 | — | — | — | — | — | — | — | — | — | — | — |
| 4 | 62 | 4 | — | 6 | — | — | — | — | — | — | — | — | — | — | — |
| 5 | 112 | 13 | — | 15 | 2 | — | 167 | 24 | — | — | — | — | — | — | — |
| 6 | 134 | 28 | 2 | 26 | 6 | — | 431 | 109 | 9 | — | — | — | — | — | — |
| 7 | 106 | 46 | 6 | 28 | 12 | 2 | 548 | 291 | 42 | 280 | 148 | 21 | — | — | — |
| 8 | 53 | 58 | 12 | 19 | 20 | 4 | 390 | 523 | 120 | 280 | 375 | 86 | — | — | — |
| 9 | 16 | 58 | 20 | 7 | 26 | 9 | 157 | 700 | 267 | 131 | 585 | 224 | — | — | — |
| 10 | 3 | 46 | 27 | 2 | 25 | 15 | 37 | 711 | 463 | 34 | 642 | 417 | — | 273 | 481 |
| 11 | — | 27 | 30 | — | 18 | 20 | — | 519 | 640 | — | 487 | 601 | — | 734 | 1321 |
| 12 | — | 12 | 27 | — | 9 | 21 | — | 281 | 700 | — | 270 | 673 | — | 586 | 1895 |
| 13 | — | 4 | 20 | — | 4 | 18 | — | 112 | 620 | — | 109 | 604 | — | 284 | 1957 |
| 14 | — | — | 11 | — | — | 12 | — | — | 401 | — | — | 394 | — | — | 1382 |
| 15 | — | — | 5 | — | — | 6 | — | — | 212 | — | — | 209 | — | — | 780 |
| 16 | — | — | 2 | — | — | 3 | — | — | 98 | — | — | 97 | — | — | 374 |
| TOTAL | 508 | 296 | 162 | 104 | 122 | 110 | 1730 | 3270 | 3572 | 725 | 2616 | 3326 | — | 1877 | 8191 |

SUMMARY OF ALL HARVEST

| | Cubic feet to a top DOB 4″ | 6″ | Board feet to a top DOB 8″ |
|---|---|---|---|
| Thinned @ age 15 to 79 BA | 347 | 124 | — |
| Thinned @ age 25 to 84 BA | 957 | 669 | 233 |
| Final harvest volume | 3572 | 3.326 | 8191 |
| Total 35 year growth and yield | 4876 | 4119 | 8424 |

Source: Baldwin, V. C. et al 1986. Loblolly pine growth and yield prediction system for thinned or unthinned plantations in the West Gulf Region (in process).
[1]Assumes $SI_{50}=80$ ($SI_{25}=58$), 700 TPA planted

## MARKETING AND THE CHIPPING HEADRIG

The 156 plant locations where the chip-and-saw milling process is used are fairly well scattered across sections of the South containing the southern pine resource (figure 5). Most mills with chipping headrigs have a wood procurement radius of about 50 miles, but this may vary depending on local conditions.

*Figure 5. Chipping headrig mill locations.*

Based on the most recent forest inventories of the southern states, there are over 28 billion cubic feet of southern pine timber in the more common chip-and-saw size classes (table 2). This volume, representing over 350 million cords, is backed up by sizable inventories in the 5-6 inch diameter classes which will soon be in-growth into a size suitable for the chip-and-saw size class.

A separate category for straight 6 to 10 inch DBH trees should be included on cruise tally sheets to help determine chip-and-saw volume estimates. With potential chip-and-saw stems identified and tallied separately, the seller has the option of marketing subsawtimber stems as either pulpwood, chip-and-saw, or both. Sellers should always remember that each product class must have an average minimum cut per acre to make it attractive to potential buyers. These minimum operability standards vary across the South but generally are no lower than 5 cords per acre for pulpwood and 5 cords per acre for chip-and-saw.

Product specifications for chip-and-saw vary by location, demand, and other factors, but a general minimum description would be a straight, relatively knot-free bole a minimum of 20 feet long, 9 inches DOB on the large end and 5 inches DIB on the small end with 4 or more growth rings per inch. Scaling practices should be determined locally.

Chip-and-saw timber is generally sold by the standard cord on a weight basis, and stumpage prices are usually quoted in dollars per ton. Conversion rates will vary by locality and species, (5,400 pounds per cord for Coastal Plain loblolly is frequently used). Approximately 3.5 cords will yield 1,000 board feet, International ¼ inch log rule, Form Class 78, or 288 board feet International ¼ per standard cord.

Tree length logging is normally used when harvesting chip-and-saw timber. This type logging requires close supervision in thinnings to minimize damage to the residual stand. One excellent harvesting system uses a shear-feller buncher to cut and pile trees near skidding

Table 2. Growing stock volume by species and state in diameter classes normally providing most chipping headrig raw material.

| | Billion Cubic Feet (7.0″ -10.9″ DBH) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **States** | AL | AR | FL | GA | LA | MS | NC | OK | SC | TN | TX | VA | TOTAL |
| **Species** | | | | | | | | | | | | | |
| Longleaf | 0.42 | — | 0.51 | 0.33 | 0.11 | 0.21 | 0.18 | — | 0.23 | — | 0.04 | — | 2.03 |
| Slash | 0.38 | — | 1.63 | 1.92 | 0.25 | 0.27 | 0.01 | — | 0.29 | — | 0.12 | — | 4.87 |
| Shortleaf | 0.90 | 1.49 | 0.01 | 0.74 | 0.42 | 0.95 | 0.81 | 0.38 | 0.50 | 0.31 | 0.83 | 0.37 | 7.71 |
| Loblolly | 2.09 | 1.01 | 0.12 | 2.27 | 1.45 | 1.49 | 1.47 | 0.02 | 1.64 | 0.15 | 1.27 | 0.70 | 13.68 |
| TOTAL | 3.79 | 2.50 | 2.27 | 5.26 | 2.23 | 2.92 | 2.47 | 0.40 | 2.66 | 0.46 | 2.26 | 1.07 | 28.29 |

Source: Most Current Forest Survey in Each State

corridors. Some mills do not accept sheared logs and again this should be determined locally.

In most areas of the South, sawtimber is still the final product and goal for management. Clearcutting stands for chip-and-saw products may (1) be marketing the timber just before it grows into a more valuable sawtimber product and (2) eliminates the option of natural regeneration and commit the landowner to artificially regenerating the stand. On the other hand, merchandising timber as chip-and-saw can be advantageous to the landowner if it is done with a good understanding of both the present and potential worth of the stand.

The key points to know are:
— the management and product objectives of the landowner
— the current and potential inventory by forest product classes
— the relative strengths of local markets by forest product classes
— when to sell and how to merchandise into the product classes most advantageous to the landowners objectives

Chip-and-Saw Pros and Cons

| PROS | CONS |
|---|---|
| • An excellent form of utilization to bridge the gap in the thinning regime from pulpwood to sawtimber. | • Thinnings must be made thoughtfully so future sawlog production is not reduced by removal of too many of the dominates and co-dominates. |
| • Increases cash flow of a forest; hence increasing the return on the forest investment. | • Increased logging supervision is needed in thinning to reduce the damage of tree length logging. |
| • Increases cash realization in the event timber stands must be harvested before reaching sawlog size. | • Sellers must know their timber and markets well to insure that the timber is being sold for the highest valued product. |
| • Often will make light intermediate cuts operable by a combination of chip-and-saw and sawlog production. | |

Suggested Reading

Baldwin, V. C., Jr.; Feduccia, D. P. Loblolly pine growth and yield prediction system for thinned or unthinned plantations in the West Gulf Region. Res. Pap. (In Process) New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station.

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